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TEAM TOOLS AND TECHNIQUES:
A TOOLBOOK APPLICATION

A Research Paper

Presented To

The Directorate of Research

Air Command and Staff College

In Partial Fulfillment of the Graduation Requirements of ACSC

by

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DISCLAIMER

The views expressed in this ToolBook and paper are those of the authors

PREFACE

This is an accompanying paper to the ToolBook application “Team Tools and Techniques” created for the National Guard Bureau (NGB) Quality Center. The ToolBook is an interactive, multi-media, computerized training course on the use of basic quality team tools and techniques. The User’s Guide in the appendix is to be used with the ToolBook as a stand-alone course, as a refresher course, as a resident course with an instructor, or as a course for a Process Action Team to train team members.

ACKNOWLEDGMENTS

The Quality Tools research team wishes to acknowledge people and organizations that provided guidance, suggestions, and information. Without the assistance of the people and organizations listed below, this project would have been impossible.

- Lt Col Sawner, National Guard Bureau Quality Center
- Capt Morales, National Guard Bureau Quality Center
- The Staff of the National Guard Bureau Quality Center
- Air Force Quality Institute

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Title: Team Tools and Techniques: A ToolBook Application

Subject: Quality tools and techniques training and instructional ToolBook.

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Abstract: This project provides a computer application and ToolBook that captures basic quality concepts, tools and techniques that enhances the overall understanding of the Quality Air Force and Air National Guard Quality Air Force programs. This application will allow for greater versatility in training by reaching greater numbers of personnel, provide a self-paced training atmosphere, and allow more versatility particularly to Air National Guard Quality Advisors and Commanders in the enhancement of their respective Quality Air Force programs. In addition, this program allows greater flexibility in training regular Air Force personnel across the globe on the use and application of team tools and techniques. This will reduce the amount of “in-class” time for personnel and reduces associated training costs and TDY expenses. Quality Advisors will be able to be more responsive to both base and active process action team training needs. Finally, this ToolBook would better serve the ACSC student in learning these tools and techniques as a stand-alone ToolBook.

Abstract

Team Tools and Techniques: A ToolBook Application

This research project developed a portable training instrument to be utilized by the Air National Guard (ANG) to train its 117,000 personnel. The training is focused primarily, but not be limited to, Quality Air Force (QAF) Concepts, Tools and Techniques; and, provision of computer based hands-on application/examples for direct applications. This ToolBook will be used by Quality Advisor and Commanders as an initial awareness course and as an adjunct to provide Just-in-Time (JIT) training for process action teams.

This pilot project developed, tested, and refined this computer ToolBook application and it will become the baseline for future ToolBook developments. The testing included a representative sample of ANG personnel who were attending the National Guard Bureau (NGB) Team Tools and Techniques course at the NGB Quality Center staff. The end product expands the existing capability and knowledge base by providing a highly versatile and mobile training tool. This interactive and user friendly ToolBook enhances the learning process by requiring student interaction. It also incorporates “real world” examples and extra problems. Finally, it provides a companion User’s Guide that allows for other training uses and programs such as a stand-alone course, a refresher course, a classroom course, or a training tool for process action teams. This ToolBook has application to also provide a portable training program on Quality Team Tools and Techniques to USAF and potentially DoD personnel.

Introduction

Quality Air Force is here to stay and is fast becoming a part of our culture; however, the need for training Air Force personnel in such fundamentals as the use of team tools and techniques has grown in demand. In response, the major commands each developed training programs to meet their initial needs and, in many instances, ran up against “false” starts. Eventually, the Air Force created the Air Force Quality Institute to become the central repository and training center that aligned all essential quality training programs.

While the Air Force Quality Center answered some of the training needs of Commanders and their Quality Advisors, it was only the tip of the iceberg. Indeed, the training program was not capable of training such large numbers without high costs in both time and expense. The Air National Guard Bureau also moved forward to create a Quality Center to initiate Quality Air Force programs for its 117,000 personnel located at some 600 geographic locations. They created several critical programs to train their senior leaders and personnel; however, with increasing budget cuts, the costs of having personnel attend the resident course or sending instructors to the field reduced their ability to reach the 117,000 assigned personnel.

This created the need for a low-cost method to train personnel, specifically the basic course of team tools and techniques. In spring 1994, a staff member from Air Command and Staff College met with the NGB Quality Center staff and discussed solutions to their problems in terms of a research project that would develop a ToolBook application that could be mass produced and sent to every unit. This ToolBook would be

an interactive computer application to give the same training to personnel that they would have received by attending the resident course.

This paper accompanies that ToolBook application and explains the objectives of the project, the methodology, the procedures, highlights, and summary of findings. This ToolBook application is a first of its kind to be created as a stand-alone training course in the quality arena. It provides greater flexibility to meet training needs, enhances the learning process through the use of interactive technology, and enhances the training capability of the NGB Quality Center. Indeed, we feel that this tool has not only an application in the ANG; but, has an application at ACSC, throughout the Air Force, and even the DoD.

TEAM TOOLS AND TECHNIQUES: A TOOLBOOK APPLICATION

Objectives

This team project was to develop a computer application and ToolBook that captures basic quality concepts, tools and techniques that will enhance the overall understanding of the Air National Guard Quality Air Force program. Such an application will allow for greater versatility in training by reaching greater numbers of personnel, provide a self-paced training atmosphere, and allow more versatility to Air National Guard Quality Advisors and Commanders in the enhancement of their respective Quality Air Force programs.

This ToolBook application and training instrument was to focus primarily on Quality Air Force (QAF) concepts, tools and techniques using a hands-on approach; thus providing a flexible and versatile training tool. The overall objectives set forth by the team were:

- Develop a new and innovative training method to train the 117,000 NGB personnel as quickly and efficiently as possible.
- Develop and build the research team in Quality Air Force methods, training programs, and applications in the field.
- Conduct research on the latest education and training programs and techniques in use by the Air Force, NGB, and other organizations.
- Meet with our customers, NGB, and survey their quality programs to date, their training programs, and evaluate their existing and future training needs
- Plan for constructing, evaluating, and distributing a training ToolBook through or by:
 - A. Identifying customer needs, demographics, and test groups
 - B. Researching training materials and courseware to meet customer needs
 - C. Constructing a ToolBook

- D. Evaluating and testing the ToolBook on selected test groups
- E. Reevaluating and refining as necessary (standardize)
- F. Delivering final product to NGB

To meet these objectives, the team conducted research on existing training programs in Quality Air Force team tools and techniques. We first surveyed the needs of the NGB Quality Center whereby we specifically defined their needs for a hands-on, computer based, multi-media ToolBook program. The program would be used by Wing and Base level Quality Advisors and Commanders as an initial awareness course in quality concepts, team tools and techniques. The team exceeded the objectives and needs of NGB by developing the ToolBook to also be an adjunct course to be used by facilitators and team leaders by providing teams Just-In-Time (JIT) training. In addition, the ToolBook serves as a refresher course or can be used in the resident course.

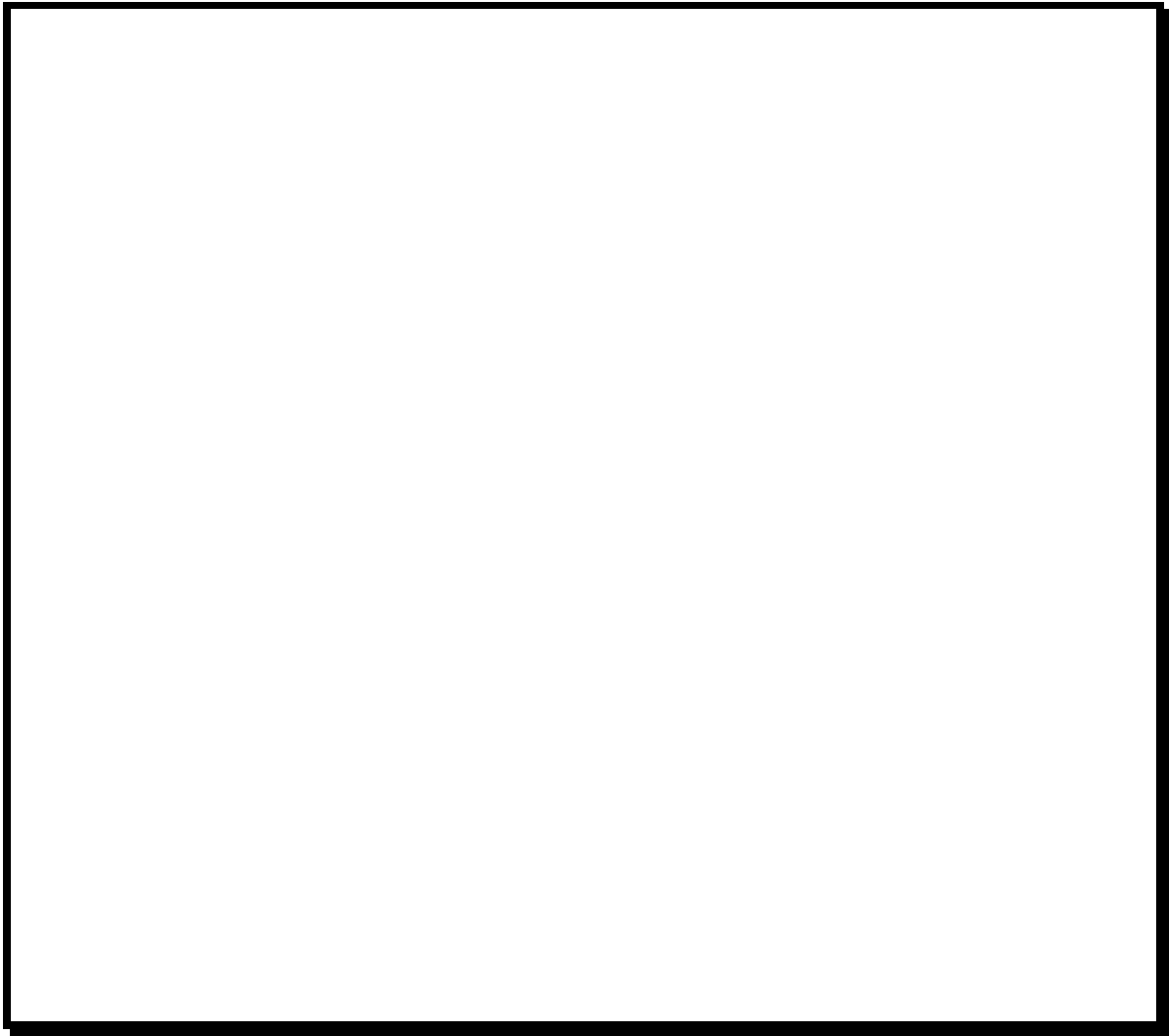
A pilot project for testing and refining the Quality ToolBook application was conducted by team members during an actual class using both NGB students and staff. This was done over the three-day Team Tools and Techniques course conducted at the NGB Quality Center and provided essential feedback from instructors and students necessary to tailor the ToolBook to meet NGB needs.

Methodology

The research design of this project was to first determine the actual customer requirements of the National Guard Bureau Quality Center. An initial survey was forwarded to the NGB Quality Center staff and subsequent interviews were completed. Upon completion of the initial survey, we conducted a literary search of all relevant programs, research, and publications. Two team members studied and learned how to utilize the multi-media ToolBook program and program ToolBook applications. The

team leader was the alternate ToolBook programmer and developed a storyboard tool that greatly enhanced the team's ability to storyboard the ToolBook into a cohesive and well-defined product before programming. This storyboard tool facilitated programming by flowcharting the program flow, connections, hotwords, layout, and appearance. This tool can be used by future ToolBook programmers to make their work easier and is shown in Figure 1.

Once the relevant research was completed, a follow-up telephone interview with the NGB Quality Center was conducted to refine our approach to the ToolBook prior to programming. Initial storyboards were completed on the first two tools and programmed. From the research and surveys, we decided to use or create existing "real world" examples for the tools and techniques that the average Air Force person would see in their day-to-day work at a wing. These examples were also tied together and some built from one tool to the other in the same way an actual Process Action Team (PAT) would be using the tools to improve a process. This method was based upon the extensive experience from team members at the Squadron, Wing, Numbered Air Force, and MAJCOM levels as either PAT team members, PAT Team Leader, Facilitator, Quality Advisor, or Quality Air Force Instructor.

A large, empty rectangular box with a thick black border, intended for drawing a storyboard.

NOTES:

Figure 1. Storyboard Worksheet

Procedures

The team attended an actual resident NGB Team Tools and Techniques course to tie in all that are taught at the course and incorporate it into the ToolBook application. The first two tools were shown before and after the students completed the course in order to determine effectiveness and utility. These were also shown to the instructors and staff. All ideas, suggestions, and comments were incorporated into the completed ToolBook; however, throughout its development, the team kept in constant contact with the customer (NGB) and solicited and received feedback. The result is a stand-alone training package in the form of an interactive, multi-media ToolBook application.

The ToolBook was found to contribute to the existing knowledge base by expanding the capabilities of the NGB Quality Center to quickly deploy their training programs to the 117,000 assigned personnel at over 600 locations. From the students at the resident course, we received feedback that the ToolBook was a far better training method because of its interactive multi-media capability. In addition, comments were received on the examples used in the ToolBook in that they made the tools and techniques come to life through day-to-day examples. This enhances not only the learning process, but also reinforces the culture change necessitated by the Quality Air Force movement.

The information and data used in the development of the ToolBook was based upon relevant research, current publications, current programs, and common sense approach. One team member had absolutely no previous background in quality methods and served as the “common sense” test person for our ToolBook. The examples we selected are standard examples that are used to teach the specific tools in most courses; however, we refined the student working examples to be those problems they would face

at a typical wing in normal day-to-day operations. From research at the Air Force Quality Institute, there is no current training program that incorporates real-world examples for students. The examples currently used are basic building block academic examples, which make it difficult for the student to assimilate and use back in their work areas. We determined to combat that problem and bridge the gap between the course and the application in day-to-day activities. When the student can use the tool in an area he or she would see in the work arena, that tool becomes more important and hence deeper understanding occurs. This increases the comprehension level of the student.

The data examples we used were tried on students before and after they took the NGB Team Tools and Techniques course. The approach was found to be innovative, unique, and breaks ground for future applications in training areas that must go out to large audiences but at reduced costs in both expense and time. With austere budgets and further reductions looming on the horizon, this method of training will become increasingly important to the commander in the field as well as the time-crunched staff that can ill afford to let members attend outside training courses.

Review of the literature is summarized in the bibliography. Exhaustive interview, constant survey and contact with the customer, and research of existing programs all came together in the development of this ToolBook. The ToolBook was designed for the adult learner, typically a junior NCO or officer, and incorporated a multi-media interactive approach that keeps the student involved. The User's Guide (see Appendix) was created to complement the ToolBook providing a handy note taker for the student to further personalize the learning process. More than that, the guide also expands the use of the ToolBook by providing an apparatus for training quality team tools and techniques as a

stand-alone course on the computer. It can also be used as a refresher course on the computer, a student guide and resource for a resident course, or a stand-alone portable tool for facilitators and team leaders to use to train PAT members while working on improving a process.

The development of the ToolBook was greatly enhanced by use of our storyboard worksheet. Using these sheets, each team member outlined their specific tool and the flow as they expected it to appear in the actual ToolBook. The team took these storyboards and constructed each tool application, its appearance, the hotwords, the examples, and interconnected each tool, each example, and each section. This made the programming far easier and efficient, consuming less time and effort for rewrites or reprogramming. In fact, our worksheet was used by several other research teams working on ToolBook applications. The development phase was systematic following a pattern of research, discussion, storyboarding, discussion, feedback from the customer, programming, refinement, feedback from the customer, and pilot test. Each tool was thoroughly examined in its programmed format, refined, and then each tool was checked on its interconnectivity with the other tools within the program.

Feedback from NGB Quality Center staff aligned the ToolBook with the existing resident course and the ToolBook will serve now as the training method for this course, reaching their 117,000 personnel in a very rapid manner. NGB will accomplish this by mass producing the ToolBook and user guide and sending copies to their 600 units, senior leaders, and Quality Advisors. This technology product has been fully integrated as a stand-alone training course supporting the project objectives, methods, and design. When this ToolBook is issued by the NGB Quality Center, it will be the first such mass use of a

ToolBook application not only in the quality arena or the National Guard, but within the Air Force. This ToolBook has further application within the ACSC curriculum to replace the existing course on Quality Tools and Techniques; which past experience shows to have been poorly received and understood. The incoming ACSC Quality Advisor, a member of this research team, will promote the use of this ToolBook in future ACSC classes.

Major Points

The ToolBook and user guide provide training to the student in the basic problem solving process central to quality techniques. The basic tools and techniques are broken down into the four components of: a) Tools for Generating Ideas, b) Tools for Making Decisions, c) Tools for Analyzing Problems, and d) Tools for Analyzing Data. These components mirror the areas selected and used by the Air Force Quality Center in their Air Force Improvement Guide.

The basic tools detailed in the ToolBook and user guide are:

- 1) Brainstorming
- 2) Nominal Group Technique
- 3) Decision Matrix
- 4) Flowchart
- 5) Cause and Effect Diagram
- 6) Pareto Chart
- 7) Histogram
- 8) Run Chart
- 9) Control Chart

Each tool is defined, explained how it used, where and when it is used, why it is used, and a basic interactive example given. Then the student is given a scenario to use the tool requiring student interaction along with use of the companion user guide. At any point within the ToolBook, the student may go back and review a topic or section. If the

ToolBook is being used as a refresher course, the student can go right to that particular tool and review. Anticipating student needs, the NGB Quality Center staff will be available to answer any questions that may arise. In addition, there will be feedback forms, NGB specific, to gather student responses and feedback to further refine the course and/or ToolBook.

To further enhance the ToolBook for use by PAT team leaders and facilitators, we include a section on Tools for Team Building. This section is in the user guide and aids team building as well as provides a portable training tool for just-in-time training of team members.

SUMMARY

This ToolBook will be the first mass-utilized, interactive, multi-media, computerized training course of its kind. The ToolBook will be used by the National Guard Bureau to train its 117,000 personnel on basic quality concepts throughout its 600 units. Some 500 copies of the ToolBook, user guide, and Statistical Process Control (SPC) program will be made and distributed. As the product is distributed and used, users will be solicited for feedback to refine the ToolBook and course. In addition, these surveys will serve as a baseline study for a paper on quality training and education that will be submitted to several professional publications and as a paper presentation at the Quality Air Force Symposium.

The storyboard worksheet greatly enhanced the ease of programming and integrated the concepts and examples within the ToolBook. The use of “real world” examples aided the learning process reinforcing comprehension by demonstrating the utility of the tools in one’s day-to-day work. The worksheet should be distributed to future ToolBook application teams to aid their work. Also, the ToolBook should be used as a replacement to existing Quality Tools training in the ACSC curriculum. From responses by several ACSC students who reviewed our ToolBook, the ToolBook enhanced their understanding by clearly defining and demonstrating the use of the tool as well as providing a more “close to home” or “real world” example to work.

Clearly, this particular ToolBook application will be widely used and dispersed among the National Guard Bureau’s 117,000 personnel. It also is clear that the ToolBook can and should be used by ACSC in their curriculum. The utility of this ToolBook is even

far reaching in that it should be sent out to active Air Force units for use and even further, the Department of Defense. It makes sense to use this technology to effectively train personnel in essential quality management tools and techniques as mandated by executive order. It makes sense to use this more effective training method in light of our increasing downsizing and budget constraints while meeting the mandate of Quality Air Force today.

APPENDIX

TEAM TOOLS AND TECHNIQUES USER S GUIDE

(As submitted with ToolBook to NGB Quality Center)



TEAM TOOLS AND TECHNIQUES

CREDITS

This program was produced by students, faculty and staff of the Air Command and Staff College located at Maxwell AFB, AL, DSN 953-6794.

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National Guard Bureau Quality Center



The ToolBook program was created using Multi-Media ToolBook(TM), a software authoring program from Asymetrix Corp. and uses their Hypermedia Book layout and navigation shell.

Tools and Techniques

ToolBook User s Guide

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PURPOSE OF THE USER S GUIDE

The purpose of this User's Guide is to provide the student a companion written guide while using the ToolBook program. This guide complements the ToolBook by providing key points and summary notes. This will allow the student to personalize his or her learning experience .

The User's Guide also provides hard copies of the ToolBook scenarios to allow for student work independent of the program, reinforcing the application of that particular tool and technique.

There are also extra problems for the student to work to check their progress and understanding of the particular tool and technique.

HOW TO USE THE USER S GUIDE

This guide is formatted to follow the ToolBook application program; however, it also mirrors the actual courses and programs conducted by the Air National Guard Quality Center. Thus, this guide can be used in the following methods:

1. As a companion student guide, note taker, and workbook when used in conjunction with the ToolBook application alone. The student will use the guide as they are using the ToolBook as stand-alone training.
2. As a companion student guide, note taker, and workbook when used in conjunction with the ToolBook application alone. The student will use the guide as they are using the ToolBook as refresher training.
3. As a companion student guide, note taker, and workbook when taking the Team Tools and Techniques course.
4. As a companion student guide, note taker, and workbook when being instructed by a Team Facilitator or Team Leader for a Process Action Team.

section 1:toolbook
fundamentals

SECTION 1 TOOLBOOK FUNDAMENTALS

This HyperText ToolBook was designed by the Air Command and Staff College (ACSC) to familiarize members of the Air National Guard with quality team tools and techniques.

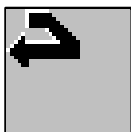
Material in this book is based on Air National Guard Quality Center Guide and the Air Force Quality Institute Process Improvement Guide. The ACSC faculty and staff can provide further references and expertise.

If you haven't used an interactive HyperText program like this before, read the following paragraphs or refer to the ToolBook pages carefully to learn the basics on how to use this HyperText book. You can refresh your memory at any time by entering the help menu in the ToolBook at the top of each page and reviewing the four topics.

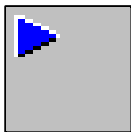
A hypertext program uses buttons, graphics and hot words (special text) to allow you to move (navigate) throughout the different pages in the program. If you have never used a hypertext program before take a few minutes to review the three topics in the ToolBook or as shown below:

- [1] The first topic, **Using Buttons to Navigate**, will show you how to use the icons you see at the top of the screen to move (navigate) throughout this program.
- [2] The second topic, **Hot Words and Other Objects**, will show you how to use "Hot Words" and other graphical icons to get additional information or, to "jump" elsewhere in the program.
- [3] The third topic, **Using the Menu Bar**, will explain the different actions you can do by using the File, Page, and Help menus located on the menu bar.

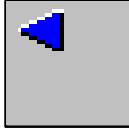
You can click on one of these buttons at the top of a page to move through the ToolBook.



This button will send you **back** to the page you were on, prior to your last jump, regardless of page sequence in the book.



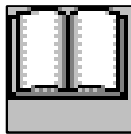
This button will send you one page "forward" in the book. Use this button to navigate through the book page by page.



This button will send you one page [backward](#) in the book.



This button will send you to the [index](#) page.



This button will send you to the [Table of Contents](#) page.



This button will [return](#) you to the first page of the chapter you are currently in.

section 2: student manual

SECTION 2 STUDENT MANUAL

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SUMMARY

PROBLEM-SOLVING PROCESS

INTRODUCTION

TOOLBOOK INTRODUCTION

The Quality AF Program centers around process improvement in order to better accomplish the mission. It provides a common language and methodology for AF members that helps everyone understand the improvement process. The systematic application of quality tools and techniques is a central feature to this program. You may one day find yourself on a process action team tasked with solving a complex problem. Your success or failure may hinge on how well you relate the information presented in ~~the~~ ToolBook. In an attempt to demonstrate how quality tools are incorporated into the problem solving process, we will begin with a quick overview of the six step problem solving process. The six step process, reviewed briefly on the next page, incorporates quality tools to generate ideas, make decisions, analyze problems, and analyze data. Once again, it is important for you to remember that the focus of ~~the~~ ToolBook is on team tools and techniques and not an in depth review of the problem solving process. For a more thorough review of this process contact the ANG Quality Center at DSN: 356-5139 or commercial: 703-285-5139.

The Six Step Problem-Solving Process is outlined below:

Step 1. Identify and Select the Problem

Step 2. Analyze the Problem

Step 3. Generate Potential Solutions

Step 4. Select and Plan the Solution

Step 5. Implement the Solution

Step 6. Evaluate the Solution

Success or failure of your team will be based on how well you can solve the problem you were chartered to address. The six step process reviewed (briefly) below incorporates the quality tools used to generate ideas, gather information, or analyze data. Once again, it is important for you to remember that the focus of this ToolBook is on team tools and techniques and not an in-depth review of the six step problem-solving process. Now we'll take a brief look at the six steps of the process and identify the objective and team tools frequently used to work through each step.

Step 1. Identify and Select the Problem

Identifying the problem is done by writing a clear and concise statement specifying a desired goal. This is an information gathering process and requires tools to help define the problem. The specific tools are:

- a. Brainstorming
- b. Nominal Group Technique
- c. Cause and Effect Diagrams
- d. Flow Chart

A key point to remember is that defining a problem is not as simple as it may look, but a vital process. Once the problem is validated, you must gather information relevant to the key aspects of it.

Step 2. Analyze The Problem

Objective: To obtain details, data and other information to identify key areas of the selected process which can be improved. Just like the previous step there are tools to help us gather and analyze causes of the problem.

- a. Brainstorming
- b. Nominal Group Technique
- c. Cause and Effect Diagrams
- d. Flow Charts
- e. Pareto Diagrams
- f. Run Charts
- g. Control Charts
- h. Histograms

Once your team is more knowledgeable of the process and you've reviewed your opportunity statement you're ready to generate potential solutions.

Step 3. Generate Potential Solutions

Objective: To identify as many ways to eliminate impediments to the process as possible.

The tools to help generate potential improvements are the following:

- a. Brainstorming
- b. Nominal Group Technique
- c. Cause and Effect Diagrams
- d. Flow Charting

Once potential improvements are generated, the team can begin to evaluate improvements.

Step 4. Select And Plan The Solutions

Objective: Decide on the most efficient, cost effective, and feasible solution, or solutions, from those generated in Step 3.

Once again, there are tools to help you select the best solution to include:

- a. Brainstorming
- b. Nominal Group Technique
- c. Cause and Effect Diagrams
- d. Flow Charts
- e. Pareto Diagrams

f. Decision Matrix

Once alternative solutions are evaluated, the team moves to Step 5.

Step 5. Implement The Solution

Objective: Convert improvements into a plan which can be implemented and do everything possible to ensure the plan will work well. The tools listed below will help you do this.

- a. Brainstorming
- b. Nominal Group Technique
- c. Flow Chart

After the plan is implemented the new process must be evaluated.

Step 6. Evaluate The Solution

Objective: Monitor the process to ensure the implemented improvements are working and periodically re-evaluate. The tools we use here are:

- a. Cause and Effect Diagrams
- b. Histograms
- c. Pareto Diagrams
- d. Control Charts

Since the purpose of the ToolBook is to provide you with quality tools for problem solving, the ensuing chapters will take you through a step by step process for using the tools listed above. The chapters are titled:

- Chapter 1. Tools for Generating Ideas
- Chapter 2. Tools for Making Decisions
- Chapter 3. Tools for Analyzing Problems
- Chapter 4. Tools for Analyzing Data

If you have any questions regarding this ToolBook or other Quality courses, please contact the National Guard Bureau at:

PHONE NUMBER

FAX NUMBER

COMM: (703)-285-5139

COMM: (703)-285-5126

DSN: 356-5139

DSN: 356-5126

tools for generating ideas

1.1 BRAINSTORMING

DEFINITION

- A structured approach to thinking, which helps a group of people utilize their collective brain power to generate new ideas.

- Why does brainstorming work?

- Foundation for other problem solving techniques.
- Large number of ideas in short period of time
- Free association of ideas and creativity.
- Participants think about and evaluate ideas or problems
- Builds on ideas suggested by others.
- Enhances teamwork, participation and group cohesiveness.

PRINCIPLES OF BRAINSTORMING

- Generate as many ideas as possible.
- Freewheeling is encouraged.
- No criticism is allowed.
- Equal opportunity to participate.
- Record all ideas.
- Let the ideas incubate.

BRAINSTORMING GUIDELINES

- Who will guide and review?
- Random or structured participation?
- Record each idea
- Keep environment open
- Rule out criticism & discussion
- Non-attribution policy
- Hitchhike ideas
- Once best ideas identified, do something

TOOLBOOK NOTES:

tools for making decisions

2.1 NOMINAL GROUP TECHNIQUE (NGT)

DEFINITION

- A structured approach to generate ideas and survey the opinions of a small (6-14 people) group.
- Why is it useful?
 - Equal voice
 - Many ideas
 - Focuses on problem
 - Builds consensus.
 - Prioritizes ideas

PRINCIPLES

- Clearly state problem.
- Write ideas
 - Members given time to write down ideas first.
 - Round-robin fashion; offer idea in short phrase and record.
- Record suggestions as given.
- Encourage participation.
- Once ideas finalized, clarify and evaluate.
- Examine and select priority items.
 - Each determines top three choices and lists
 - Individual inputs are recorded and added

2.2 DECISION MATRIX

DEFINITION

- The decision matrix is a management technique used when a complex decision needs to be made.
 - Used to determine best solution
 - Use that solution to improve the process.

DESCRIPTION

- Method for deciding on one option.
 - Used to select a few
- How options compare
- Establishes thought process
 - More benefit from limited resources.
- Prioritizes options mathematically
 - Select the best match
- Flexible tool -- can be used to select:
 - Which problems to work on first
 - The temporary fix
 - Or best alternative

PRINCIPLES

- Identifies key considerations.
 - Considerations are weighed
 - Key considerations should be phrased so all are favorable/preferable
- May be many key considerations.
 - Choose most beneficial
- Assign weight factors based on knowledge/organizational priorities.
 - Reflect relative vs. absolute importance of each consideration.
 - If one "key consideration" is absolute, may be no reason to consider others
 - Must be consensus.

PREPARATION STEPS

- Develop list
 - Rank order not important.
 - Possible solutions/problems
- List options
- List key considerations based on objectives and resources.
 - Identify ones most applicable
 - Phrased to reflect what organization needs
- Write key considerations.
 - Horizontal row across top
 - Limit to 10
- Assign "weight factor"
 - Use scale of 1-10.
 - "10" - most important
 - "1" - least important
 - Write factor below consideration.
- Assign relative ranking
 - Write in appropriate column.
- Multiply "weight factor" times ranking
- Calculate cumulative total for each option.
 - Write that number in the column at the far right.
- Rank the option list
 - Highest value becomes number one priority.
- Develop plan

TOOLBOOK NOTES:

TOOLS FOR ANALYZING PROBLEMS

3.1 FLOW CHARTS

DEFINITION

A flow chart is a method or technique using symbols to describe a process as a logical series of events. It is used to graphically describe the activities, decisions and documentation within a process.

PRINCIPLES

- Chart flows from beginning to end of the process
- Any exception should be clearly marked
- Use arrowheads on flow-lines to indicate direction
- Chart should accurately represent ~~the~~ actual, not desired process.
- Best accomplished by team with extensive process knowledge

TYPES OF FLOW DIAGRAMS:

Basically, three diagrams for every process

- A. Formal process
 - Also known as the "theoretical flow"
 - The process if everything went right
- B. Informal process
 - The "actual flow"
 - Process as practiced by people doing work.
- C. Best process

INSTRUCTIONS FOR FLOW CHART CONSTRUCTION

- Select process to be analyzed
- Decide the process scope
 - Identify first and last activity in process.
- List / outline major activities
- List / outline sub-activities
- Draw each step, using appropriate symbols

THE RESULTING FLOW CHART SHOULD BE AN ACCURATE REPRESENTATION OF THE PROCESS!

FLOW CHART SYMBOLS

Activity Symbol (Rectangle)

- Defines the activity.

Decision symbol (Diamond)

- Defines decision to be made.

Terminal Symbol (Oval)

- Identifies beginning or end of a process

Connector (Circle with number or letter in it)

- Indicates next step when arrows would be too confusing
- connects to the same letter or number in another location in the chart

TYPES OF FLOW CHARTS

Macro Flow Charts

- Determine and sequence the high-level steps in a process without becoming bogged down in the details.
- Help simplify each chart, making them easier to follow.

Micro Flow Charts

- More detailed, or low-level procedures in a process.
- Each major step in a macro flow chart should be represented in a micro flow chart.
- Very complex tasks may have more than one micro flow chart.

KEY CHARACTERISTICS

- Illustrates actions performed
- Identifies, records, analyzes & communicates
- Limits scope of process
- Useful to solve problems related to procedures.
- Breaks process down
- Defines actual process
- Identifies weakness, redundancy and opportunities for errors
- Identifies data collection points.

3.2 PARETO CHART

DEFINITION

A bar chart prioritized in descending order from left to right, distinguished by a cumulative percentage line that identifies the vital few opportunities for improvement.

HISTORICAL PERSPECTIVE NOTES

- Vilfredo Pareto -- an Italian economist born in 1848.
- Studied unequal distribution of wealth; designed mathematical prototype of "PARETO ANALYSIS" or "THE PARETO PRINCIPLE".
 - Using tax and census data, he was to increase taxes
 - Found 20% controlled 80% of the wealth
 - Couldn't increase tax by additional taxes on majority (80%); they had limited wealth (20%).
 - Became known as "80-20 Rule."
- Used bar graph with bars arranged in descending order show difference in income
- Juran was first to apply Pareto's principle to quality problems.
 - Said principle was universal in its application to any problem distribution.
 - Application of the principle became known as: "The Pareto Principle" or the "Vital Few, Trivial Many".

PRINCIPLES

- Track the top priority problems or causes first.
- All requirements / actions must be examined.
 - Ask: "What could prevent this requirement / action from being accomplished?"
- All inputs to a process provide opportunities for error.
- Brainstorm to build a comprehensive check sheet of all possible errors.
- Team members should have extensive knowledge of process and/or problem.

INSTRUCTIONS FOR PARETO CHART CONSTRUCTION

STEP 1: Determine how to categorize data

- Choose the problem or cause categories
 - By error type
 - By organization
 - Specific action; i.e., OPR/EPR late submissions
- Data Category

- Seat belt violation
- OPR/EPR late submissions
- Safety violations

STEP 2: Collect Data

- Type of problem/cause with measurable time period
- The higher the incident rate the lower time period needed
 - 100 errors a day, few days required
 - 1 error a week, may require a year's worth of data

STEP 3: Summarize the Data

- Show the number of errors
- Error category, number, impact.
- Data Category
 - Seat belt violations
 - OPR/EPR late submissions
 - Safety Violations

STEP 4: Construct Bar Graph of Data

- Bars of descending order (l to r)
- Horizontal axis = categories of data
- Vertical axis = frequencies
- Scaled so cumulative data can be plotted on same graph

STEP 5: Add a cumulative line representing total percentage of non-use.

STEP 6: Place legend on the chart

- Should contain information such as:
 - Categories of data
 - Period covered
 - Source of data
 - Name of person preparing study
- Important because it documents data, sources, and provides future reference

KEY CHARACTERISTICS

- Narrows down possible sources of trouble.
 - Rank order/prioritized in order of importance.
- Of all contributing factors, only small number account for bulk of the effect.
- Used to set goals for improvement.
- Enhances communication about priorities
- Zeroes in on major categories of non-conformance.
- Also used to narrow scope of problem.
 - Helps define situation.

3.3 CAUSE AND EFFECT DIAGRAM

DEFINITION

An analytical method using logic and creative thought to graphically represent and arrange causes of a situation. (Also known as *fishbone*, or *Ishikawa diagram*).

PRINCIPLES

- Separates causes into categories
- Major categories:
 - "4Ms" (Machinery, Manpower, Methods, Materials)
 - "4Ps" (Policies, Procedures, People, Plans)
 - Team may develop other categories
- Evaluate each category-- anything that might explain the effect should be considered a possible cause.
- Completed, detailed diagram shows depth of what is known about a problem
- Separate diagrams for each problem

CONSTRUCTING A CAUSE AND EFFECT DIAGRAM

- Use paper / board large enough for a diagram
- Clearly state problem or effect
- Start by placing problem statement in a box at right; draw line pointing to the box
- Decide the major categories (4Ms, 4Ps, etc.) and write them in boxes
- Organize or brainstorm all possible causes -- one category at a time
- Ask, and continue to ask "Who, What, When, Where, How and WHY!"
- Record all possible causes on diagram
 - Discuss each item for clarity
 - Causes should be divided and subdivided to show how they interact
 - Draw links between causes which are interrelated.
 - Continue listing UNTIL THERE ARE NO NEW IDEAS
- Evaluate and analyze possible causes.
 - Condense/combine possible causes
 - Examine relationships between causes -- solutions frequently emerge
- Prioritize possible causes for further investigation
 - Use Pareto analysis/other techniques
 - Circle most likely causes
- Develop action plan

KEY CHARACTERISTICS

- Powerful technique to graphically depict / organize causes of a situation
- Combines analytical and creative thought with team effort
- Breaks problems into smaller pieces
- Searches for root causes
- Helps teams generate / record ideas
- Visually displays relationships of causes
- Records relevant detail
- Historical document of logical thought process used

FINAL POINTS AND REMINDERS:

- Effect statement: Unambiguous, non-suggestive description of a problem.
- Cause and effect diagramming generates potential causes of an effect.
- Potential causes may be analyzed statistically to identify real causes.
- Use cause and effect diagram to:
 - Identify And Select the Problem
 - Analyze the Problem
 - Generate Potential Solutions

TOOLBOOK NOTES:

TOOLS FOR ANALYZING DATA

4.1 HISTOGRAMS

DEFINITION

A histogram is a vertical bar graph that depicts the distribution of a set of continuous data. It helps keep track of variation by providing a snapshot of the process, which shows the spread of measurements, and the distribution (how many of each measurement there are).

PRINCIPLES

- Does not account for time element
 - Use in conjunction with a control chart.
- Has two scales (axes):
 - Vertical (Y) axis is for number of items or occurrences.
 - Horizontal (X) axis is for ranges (distribution).
- Process must be in statistical control for valid analysis.
 - Can't improve process that's out of control.
 - Must eliminate special causes effecting process before beginning improvement.
- Size of ranges important to identify pattern of distribution.
 - Too few groups hide the pattern.
 - Too many groups break it up.
- Use groups of equal size.
 - Prevents distribution distortion
- Label the chart clearly.
 - Include the size of the groups.

INSTRUCTIONS FOR HISTOGRAM CONSTRUCTION

- Identify and define the problem.
 - Have a clear understanding
 - Know what's to be measured: documents per hr, production rate, F-16 takeoffs per hour.
- Construct a work sheet
 - Example: Bags of lawn fertilizer weights.
 - N = number of observations = 100 for our sample.
- Collect raw data
 - Data collection method determined by team.
 - Must be creative sometimes.
- Determine the largest and smallest numbers within the raw data

- Determine the range
- Divide the range into convenient number of class intervals having the same size
 - Too wide
 - Too much data grouped together
 - Information may be lost
 - Trends hard to spot
 - Too narrow
 - Data too spread out ; histogram looks unwieldy.
- Determine boundaries for each class interval
 - Establishes horizontal scale
- Construct a check sheet
- Sort data using check sheet
- Count tally marks in each column
- Draw horizontal axis and mark class intervals
- Determine vertical scale representing frequencies/observations
 - Scale based on largest number of check marks on check sheet
- Draw vertical axis and mark frequencies/observations
- Take data from check sheet, display each class interval using vertical columns
 - Leave space between columns.
- Add a legend
 - Indicate problem studied, who collected data, when and where collected, date prepared.
- Analyze and describe the shape of the histogram
 - Does it represent a normal distribution?
 - Does data conform to requirements?
 - What corrective action should be taken?

INTERPRETING SHAPES OF HISTOGRAMS

- Bell shaped
 - When like objects or things are measured as a group, there is always variation in measurement.
 - If curve forms bell shape, it's called "normal distribution"
 - Normal curve distinguished by central peak and approximate symmetrical sides which taper off.
- Abnormal curve
 - Natural to expect normal curve so recognize and be concerned with abnormal.
 - Analyze to determine if something is wrong; if corrective action necessary.
 - Bell shape could have data measurements outside of customer specifications.

- Skewed
 - Skew tells how symmetrical or normal distribution is.
 - Skewed curve has tail at one end or other.
 - Central peak is evident, but sides are not symmetrical.
- Bimodal
 - Bimodal curve has two bell shaped curves with two central peaks.
 - Mode, a measure of central tendency. Data points occurring most frequently.
 - Often indicates two different things happening. (Example: Two different routes used in driving to work)
- Flat
 - Uniform distribution; level or evenly dispersed.
 - Typically referred to as "flat curve"

KEY CHARACTERISTICS

- Gives true picture of performance.
- Shows how many items (frequencies) fall into a series of progressive numerical ranges (distribution).
- Relates output to process performance and customer requirements.
- Shows whether distribution is normal or skewed.
- Identifies where the process is centered.
- Shows spread of outputs
- Identifies if there are values separate from the main body of data.
- Verifies distribution compared to what is required.

4.2 RUN CHARTS

DEFINITION

A simple graph used to monitor a process or activity so trends or runs can be easily identified.

PRINCIPLES

- Must have a clear, definite objective
- Variable data plotted against non-variable data
- Data can be recorded as individual numbers, averages, or percentages.
- Unbroken line connecting plotted points identifies both trends and periods of stability.
- One person responsible to ensure data collected is relevant

INSTRUCTIONS FOR RUN CHART CONSTRUCTION

- Choose data to be recorded on vertical and horizontal axis.
 - If occurrences plotted over period of time, plot occurrences on vertical axis and time period on horizontal axis.
- Decide to record data as individual numbers, averages, or percentages
- To ease plotting and reading data points, use background of grid rulings.
- Make trend line bolder than baseline, and the baseline bolder than reference grid lines.
- To plot each data point, locate the correct measurements on each axis
- After all points are plotted, connect
- Analyze for trends, changes or periods of stability

KEY CHARACTERISTICS

- Summarizes large amounts of data.
- Display value of one data point against another
 - Displays trends with these data points over time.
- Used to record:
 - Occurrences (vertical axis)
 - Over a period of time (horizontal axis).
 - Example: Daily errors in documentation.
- Useful to illustrate natural variation in process
- Monitors process to see if long range average is changing.
 - Example: Bowling center profit/loss.

- A charting tool to show interrelation of many data points (more than six or seven).
- Shows effects of corrective action -- a before and after chart.

4.3 CONTROL CHARTS

1. DEFINITION: A run chart with statistically determined upper and lower control limits.

1.1 DESCRIPTION

X-axis

The independent variable or x-axis indicates when (time) or in what order (sequence) the measurements were taken.

Y-axis

The dependent variable or y-axis is whatever process or product characteristic you want to measure.

Centerline (X-bar)

The average value of all the data points.

Upper/Lower Control Limits

Statistically determined upper and lower lines, control limits are basis for judging variation; calculated from process data (\bar{X} , σ , UCL/LCL)

Control Region

The area between the upper and lower control limits.

Specification Limits

(Optional) These are set based on customer requirements, standards, (USL/LSL) or goals.

2. USING A CONTROL CHART

2.1 ANALYZING

Technique for learning about work processes.

Allows monitoring of variability.

Shows performance over time

2.2 DETERMINING

Control charts are analyzed based on the concept that it's possible to distinguish between *special* causes and *common* causes of variation.

VARIATION:

COMMON

Common causes are due to variation inherent in process and appear randomly.

SPECIAL CAUSES

Special causes are unpredictable; they show up outside control limits

2.3 IMPROVING

Improve process by eliminating special cause and reducing common cause variation.

Eliminating special cause variation makes process predictable.

Improvement shows up as a reduction around the average.

3. ANALYZING

You can analyze control charts in a number of ways:

CONTROL CHART

Look for patterns in the graph.

Look for indicators that special causes are present.

3.1 PATTERNS

The patterns you look for in a control chart are the same as those in a run chart.

RUNS

A series of consecutive points ~~all~~ *all on one side of the average line.*

TRENDS

A series of consecutive points ~~all~~ *all increasing or decreasing.*

CYCLES

A pattern that repeats itself at regular intervals.

EXTREMES

The presence of "peaks" or "valleys" in the graph.

VARIABILITY

How spread apart the data points are from each other.

3.2 SPECIAL CAUSE

The following phenomena occurring in a control chart reveal the presence of a special cause which is affecting the process.

Any time a point falls outside of the control region, the process is said to ~~be~~ *be out of statistical control.*

Check to see if any of the following patterns have occurred:

A run of 7 or more points.

A trend of 6 points.

Fourteen consecutive points alternating up and down.

Divide each half of the control region into thirds. See if any of the following conditions have occurred:

Two out of three consecutive points in the outer third of the control region.

Fifteen points in a row within the center third of the control region.

Eight points on both sides of the centerline with none in the center third of the control region.

4. CONSTRUCTING A CONTROL CHART

4.1 PROCESS

Step 1: Collect data.

- Call each observation 'x'.
- Divide the overall group of data into 10 to 20 subgroups with 2 or more observations in each subgroup.
- Call the number of subgroups 'k' and the number of observations 'n'.

Step 2: Determine the average and the range.

- The average (\bar{x}) of a subgroup is the sum of all observations (x) in the subgroup divided by the number of observations (n) in the subgroup.
- The range (R) of a subgroup is the largest observation (x_{\max}) in the subgroup minus the smallest observation (x_{\min}) in the subgroup.

Step 3: Plot these points on the Average and Range charts, respectively.

- Set up the axes and plot points as you do for a run chart.
- The x-axis must have at least as many divisions as the number of subgroups (k).
- The y-axis must start at least as low as the smallest average/range and must go at least as high as the greatest average/range.

Step 4: Determine the overall mean.

- Obtain the overall mean ($\bar{\bar{x}}$) by adding together all the subgroup averages (\bar{x}) and dividing this sum by the number of subgroups (k).

Step 5: Determine the average range.

- The average range (\bar{R}) is the sum of each subgroup range (R) divided by the number of subgroups (k).

Step 6: Look up values for constants.

- Find the values for A_2 , D_3 and D_4 in the Table of Control Chart Constants based on how many observations there are in each subgroup (n).

Step 7: Calculate the control limits and centerlines, and plot the data.

- Use the constants from Step 5 in the following formulas.
- For the \bar{x} -bar chart (top graph):
 - CENTERLINE ($\bar{\bar{x}}$): Draw a horizontal line at the overall mean.
 - UPPER CONTROL LIMIT (UCL): Multiply constant A_2 by the average range (\bar{R}). Add this number to the overall mean ($\bar{\bar{x}}$), and draw the horizontal line.
 - LOWER CONTROL LIMIT (LCL): Multiply constant A_2 by the average range (\bar{R}). Subtract this number from the overall mean ($\bar{\bar{x}}$), and draw the horizontal line.
- For the R chart (bottom graph):
 - CENTERLINE (\bar{R}): Draw a horizontal line at the average range.
 - UPPER CONTROL LIMIT (UCL): Multiply constant D_4 by the average range (\bar{R}) and draw the horizontal line.

-- LOWER CONTROL LIMIT (LCL): Multiply constant D3 by the average range (\bar{R}) and draw the horizontal line.

The control chart is complete!

TOOLBOOK NOTES:

TOOLS FOR TEAM BUILDING

This section is for use by your Process Action Team as a reference for building your team.
This material should be presented by either a Facilitator or an Instructor.

A. SELF-AWARENESS: THE KEIRSEY-BATES TEMPERAMENT SORTER

INSTRUCTIONS

Decide on answer A or B and put a check mark in the proper column of the answer sheet. Scoring directions are detailed. There are no right or wrong answers since about half the population agrees with either answer you choose.

DIRECTIONS FOR SCORING

1. Add down so that the total number of "A" answers is written in the box at the bottom of each column. Do the same for the "B" answers you have checked. Each of the 14 boxes should have a number in it.
2. Transfer the number in Box No. 1 of the answer sheet to Box No. 1 below the answer sheet. Do this for Box No. 2 as well. Note, however, that you have two numbers for Boxes 3 through 8. Bring down the first number for each box beneath the second, as indicated by the arrows. Now add all the pairs of numbers and enter the total in the boxes below the answer sheet, so each box has only one number.
3. Now you have four pairs of numbers. Circle the letter below the larger number of each pair. If the two numbers of any pair are equal, then circle neither, but put a large "X" below them and circle it.
4. You have identified your type. It should be one of the following:

INFP	ISFP	INTP	ISTP
ENFP	ESFP	ENTP	ESTP
INFJ	ISFJ	INTJ	ISTJ
ENFJ	ESFJ	ENTJ	ESTJ

If you have an "X" in your type, yours is a mixed type. An "X" can show up in any of the four pairs. Read your type description and decide how well or how poorly the description fits.

SCORE SHEET FOR KIERSEY TEMPERAMENT SORTER

	a	b		a	b		a	b		a	b		a	b		a	b
1			2			3			4			5			6		
8			9			10			11			12			13		
15			16			17			18			19			20		
22			23			24			25			26			27		
29			30			31			32			33			34		
36			37			38			39			40			41		
43			44			45			46			47			48		
50			51			52			53			54			55		
57			58			59			60			61			62		
64			65			66			67			68			69		

12

↓

23

→ →

45

→ →

67

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88

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12

E I

34

S N

56

T F

78

J P

DIFFERENT DRUMS AND DIFFERENT DRUMMERS

THE KEIRSEY TEMPERAMENT SORTER

1. At a party do you
 - (a) interact with many, including strangers
 - (b) interact with a few, known to you
2. Are you more
 - (a) realistic than speculative
 - (b) speculative than realistic
3. Is it worse to
 - (a) have your "head in the clouds"
 - (b) be "in a rut"
4. Are you more impressed by
 - (a) Principles
 - (b) Emotions
5. Are you more drawn toward the
 - (a) Convincing
 - (b) Touching
6. Do you prefer to work
 - (a) To deadlines
 - (b) Just "whenever"
7. Do you tend to choose
 - (a) Rather carefully
 - (b) Somewhat impulsively
8. At parties do you
 - (a) Stay late, with increased energy
 - (b) Leave early

9. Are you more attracted to
- (a) Sensible people
 - (b) Imaginative people
10. Are you more interested in
- (a) What is actual
 - (b) What is possible
11. In judging others are you more swayed by
- (a) laws than circumstances
 - (b) circumstances than laws
12. In approaching others, is your inclination to be somewhat
- (a) objective
 - (b) personal
13. Are you more
- (a) punctual
 - (b) leisure
14. Does it bother you more having things
- (a) incomplete
 - (b) completed
15. In your social group do you
- (a) keep abreast of others happenings
 - (b) get behind on the news
16. In doing ordinary things are you more likely to
- (a) do it the usual way
 - (b) do it your own way
17. Writers should
- (a) "say what they mean and mean what they say"
 - (b) express things more by use of analogy

18. Which appeals to you more
- (a) consistency of thought
 - (b) harmonious human relationships
19. Are you more comfortable in making
- (a) logical judgments
 - (b) value judgments
20. Do you want things
- (a) settled and decided
 - (b) unsettled and undecided
21. Would you say you are more
- (a) serious and determined
 - (b) easy - going
22. In phoning, do you
- (a) rarely question that it will all be said
 - (b) rehearse what you'll say
23. Facts
- (a) "speak for themselves"
 - (b) illustrate principles
24. Are visionaries
- (a) somewhat annoying
 - (b) rather fascinating
25. Are you more often
- (a) a cool-headed person
 - (b) a warm-hearted person
26. Is it worse to be
- (a) unjust
 - (b) merciless

27. Should one usually let events occur
- (a) by careful selection and choice
 - (b) randomly and by chance
28. Do you feel better about
- (a) having purchased
 - (b) having the option
29. In company do you
- (a) initiate conversation
 - (b) wait to be approached
30. Common sense is
- (a) rarely questionable
 - (b) frequently questionable
31. Children often do not
- (a) make themselves useful enough
 - (b) exercise their fantasies
32. In making decisions do you feel more comfortable with
- (a) standards
 - (b) feelings
33. Are you more
- (a) firm than gentle
 - (b) gentle than firm
34. Which is more admirable
- (a) The ability to organize and be methodical
 - (b) The ability to adapt and make do
35. Do you put more value on the
- (a) definite
 - (b) open-ended

36. Does new and non-routine interaction with others

- (a) stimulate and energize you
- (b) tax your reserves

37. Are you more frequently

- (a) A practical sort of person
- (b) A fanciful sort of person

38. Are you more likely to

- (a) see how others are useful
- (b) see how others see

39. Which is more satisfying

- (a) To discuss an issue thoroughly
- (b) To arrive at agreement on an issue

40. Which rules you more

- (a) Your head
- (b) Your heart

41. Are you more comfortable with work that is

- (a) Contracted
- (b) Done on a casual basis

42. Do you tend to look for

- (a) The orderly
- (b) Whatever turns up

43. Do you prefer

- (a) many friends with brief contact
- (b) a few friends with more lengthy contact

44. Do you go more by

- (a) facts
- (b) principles

45. Are you more interested in
- (a) production and distribution
 - (b) design and research
46. Which is more of a compliment
- (a) "There is a very logical person"
 - (b) "There is a very sentimental person"
47. Do you value in yourself more that you are
- (a) unwavering
 - (b) devoted
48. Do you more often prefer the
- (a) final and unalterable
 - (b) tentative and preliminary statement
49. Are you more comfortable
- (a) after a decision
 - (b) before a decision
50. Do you
- (a) speak easily and at length with strangers
 - (b) find little to say to strangers
51. Are you more likely to trust your
- (a) experience
 - (b) hunch
52. Do you feel
- (a) more practical than ingenious
 - (b) more ingenious than practical
53. Which person is more to be complimented: one of
- (a) clear reason
 - (b) strong feeling

54. Are you inclined more to be
- (a) fair-minded
 - (b) sympathetic
55. Is it preferable mostly to
- (a) make sure things are arranged
 - (b) Just let things happen
56. In relationships should most things be
- (a) re-negotiable
 - (b) random and circumstantial
57. When the phone rings do you
- (a) hasten to get to it first
 - (b) hope someone else will answer
58. Do you prize more in yourself
- (a) A strong sense of reality
 - (b) A vivid imagination
59. Are you drawn more to
- (a) fundamentals
 - (b) overtones
60. Which seems the greater error
- (a) to be too passionate
 - (b) to be too objective
61. Do you see yourself as basically
- (a) hard-headed
 - (b) soft-hearted
62. Which situation appeals to you more:
- (a) the structured and scheduled
 - (b) the unstructured and unscheduled

63. Are you a person that is more
(a) routinized than whimsical
(b) whimsical than routinized
64. Are you more inclined to be
(a) easy to approach
(b) somewhat reserved
65. In writing do you prefer
(a) the more literal
(b) the more figurative
66. Is it harder for you to
(a) identify with others
(b) utilize others
67. Which do you wish more for yourself
(a) clarity of reason
(b) strength of compassion
68. Which is the greater fault
(a) being indiscriminate
(b) being critical
69. Do you prefer
(a) Planned event
(b) Unplanned event
70. Do you tend to be more
(a) deliberate than spontaneous
(b) spontaneous than deliberate

B. SETTING THE STAGE

OVERVIEW

- Selection of the project
- Different players on the team or guiding the team
- The team's charter

SELECTING THE PROJECT - A PROJECT SELECTION CHECKLIST

- ___ Related to key business issues?
- ___ Has direct impact on the organization's customers?
- ___ High visibility?
- ___ Managers agree it is important to study and improve this process?
- ___ Managers, supervisors and operators will cooperate?
- ___ Not being studied by another group?
- ___ Defined starting and ending points?
- ___ Not currently being changed?
- ___ Quick turnaround time?

CHOOSING THE PLAYERS

The Players are:

- Client (often the Executive Council or key individuals)
- Team Leader

- Facilitator
- Team Members (Time Keeper, Recorder)

The Client:

- Individual key leader or one of the organization's key councils
- Individual(s) who forwarded the project or process in the first place
- Established authority regarding the process
- Willing to let go of some control
- Not a member of the team--doesn't attend the meetings or conduct the actual project
- Selects the team leader or allows the team to select the team leader
- Coordinates with team leader or quality advisor on team membership
- Coordinates with team leader or quality advisor on facilitator
- Develops the charter
 - determines the mission and goals of the team
 - determines the resources willing to allocate
 - determines the level of empowerment
 - determines the time willing to provide for team meetings or other activities
 - champions and supports the team

The Team Leader:

- Manages the team
 - calls the meetings
 - handles or assigns the administrative details
 - orchestrates all team activities
 - oversees preparations for reports and presentations
 - official keeper of the team records
 - point of contact for communication
- Leads the team members
 - good at working with people
 - shares responsibility with other team members
 - creates and maintains channels of communication
 - enables team members to do their work and clients to remain out of the way

- Other qualities
 - ordinarily a process expert
 - interested in solving problems
 - not necessarily based solely on rank or position

The Facilitator:

- Attends team meetings but is neither a team leader nor a team member; is an outsider to the team who can maintain a neutral position. By observing the team's progress, the facilitator can help the team improve the meeting "process", being vigilant to stay away from "content."

- Assists the Team Leader
- Focuses on group dynamics
- Works with team leader between meetings to plan for upcoming meetings
- Assists team with knowledge of tools
- DOES NOT create agendas, take minutes, setup the room, make arrangements for the room, call team members to notify them of the meeting, do mailings, write reports, etc. These are the duties of the team members themselves as directed by the leader.

Team Members (typically 5 to 8 people per team) :

- Appointed in writing by the client or council with the coordination of the team leader or quality advisor.
- The nature of the project usually dictates appropriate membership
- They can be of various ranks, professions, AFSCs, categories
- View participation as a priority
- Team members are responsible for contributing fully during meetings and carrying out between meeting assignments

THE TEAM' S CHARTER

- An addressee block which sends the charter to all members of the team, their respective supervisors, the assigned facilitator, his/her supervisor, and any organizational element having a legitimate interest in the project
- A mission statement which tells the team:
 - What process or problem to study
 - The boundaries and limitations--including time and money
 - The magnitude of improvements they are expected to make
 - When they are scheduled to begin the project and a target completion date
 - The authority the team has to call in workers or outside experts, and

request equipment or information not normally available to them

- How often they are to meet with the client

- Where and how long they may meet as a team

- The team composition

- Charter is signed by Client, Team Leader and Facilitator

C. GETTING UNDERWAY

OVERVIEW

- General meeting rules and effective discussion skills
- Importance of project meeting records
- Goals for the first meeting:
 - Team building
 - Educational
 - Project-related

GENERAL MEETING RULES

- Use agendas
 - send to participants before meeting
- Have a facilitator
 - Although this individual is highly trained in the problem-solving process and the tools needed to advise the team, the team is still responsible for doing the work and analyzing the information using the tools themselves. The facilitator does not run the meeting. The team leader conducts the meeting with the assistance of the facilitator.
- Take minutes
- Draft the next agenda
- Evaluate the meeting
- Adhere to the "100-mile rule"

EFFECTIVE DISCUSSION SKILLS

- Ask for clarification
- Act as gatekeepers
- Listen
- Summarize
- Contain digression
- Manage time
- End the discussion
- Test for consensus

REASONS FOR SETTING UP A RECORD-KEEPING SYSTEM

- Projects often last 6 to 18 months
- Clear, illustrated records help educate and win the support
- Presentations about successful projects are widely circulated within the organization, the industry, or other ANG units.
- The team may have to retrace its steps

GOALS FOR THE FIRST MEETING

Team-Building Goals

- getting to know each other
- learning to work as a team
- working out decision-making issues
- determining support / service requirements
- setting ground rules

Educational Goals

- exploring key concepts that should govern your focus on quality improvement
- learning the scientific approach by using appropriate tools and techniques
- understanding the improvement plan and the charter ~~has~~ reasonable knowledge of tools and techniques available to assist in this task

Project Goals

- understand your charter
- understand the process assigned to you
- identify the resources you will need (time, money) to make this easier
- develop an improvement plan/road map for the team to follow during the project.

D. SIX STEP PROBLEM-SOLVING PROCESS

THE SIX STEP PROBLEM SOLVING-PROCESS

STEP 1. IDENTIFY AND SELECT THE PROBLEM

STEP 2. ANALYZE THE PROBLEM

STEP 3. GENERATE POTENTIAL SOLUTIONS

STEP 4. SELECT AND PLAN THE SOLUTION

STEP 5. IMPLEMENT THE SOLUTION

STEP 6. EVALUATE SOLUTION

STEP 1. IDENTIFY AND SELECT THE PROBLEM

A. Identify problem by writing clear and concise statement specifying desired goal

- Guidance often unclear.
- Up to team to define bounds parameters
 - If problem statement too "big," team must refine and renegotiate charter

B. Define the present state

- How is process being done now?
 - Example: For an energy conservation team, the current process could be defined as "how much energy are we using today? Additionally, what are all the ways we use energy? Finally, what conservation methods (if any) are we currently using?"

C. Identify desired future state.

D. Identify differences between present and future states.

- Allows you to place bounds on process.
 - What do we need to do differently to get to this future state?
 - What changes to the process can be suggested?
 - How do we need to change?
 - What steps do we need to drop?
 - What steps do we add in?
 - Do we need different players?
 - What is realistically achievable?

E. Determine how process impacts customer expectations

F. Establish desired goal or target.

- How difficult will this be to work through?
 - How long will it take?
 - Are resources available?

- How urgent is it?

G. Establish measurable requirements.

H. Consolidate and document problem as a goal.

I. Tools:

1. Brainstorming
2. Nominal Group Technique
3. Cause and Effect Diagrams
4. Flow Chart

STEP 2. ANALYZE THE PROBLEM:

A. Objective: Obtain details, data and other information to identify key areas of process to be improved.

- Focus on problem and gather in-depth information
- Focus on causes, effects and symptoms
- Provides baseline to analyze so we know where we are now.

B. Tasks

- Identify type and quantity of information desired.
- Identify the information format desired.
- Use facts, not gut feel ("In God We Trust, All Others Bring Data!")

C. Establish methodology to be used.

- May be toughest task.

D. Identify who is to collect and report information.

E. Document an integrated plan for data collection.

F. Implement plan, collect data, and report.

G. Tasks:

1. Challenge every detail.
2. Identify potential causes.
3. Narrow list of causes down
4. Key on areas where less than optimal performance is noted.
5. Don't make "educated guesses" on what you think is most important
6. Prioritize list of causes
7. Confirm significant causes with data
8. Review your opportunities

H. Tools:

- | | |
|------------------------------|---------------------|
| 1. Brainstorming | 6. Pareto Diagrams |
| 2. Nominal Group Technique | 7. Run Chart |
| 3. Cause and Effect Diagrams | 8. Scatter Diagrams |
| 4. Flow Charts | 9. Control Charts |
| 5. Check Sheets | 10. Histograms |

STEP 3. GENERATE POTENTIAL SOLUTIONS:

Objective: Identify as many ways to eliminate impediments to the process as possible.

A. Tasks:

1. Review steps one and two.
2. Use idea generating techniques to uncover potential improvements
3. Clarify suggestions for potential improvements to ensure all team members understand proposed solutions.

B. Tools:

1. Brainstorming
2. Nominal Group Technique
3. Cause and Effect Diagrams
4. Flow Charting

STEP 4. SELECT AND PLAN THE SOLUTION

Objective: Decide on the most efficient, cost effective, and feasible solution, or solutions, from those generated in Step 3.

A. Tasks:

1. Define desired criteria.
 - Consider customer requirements, resource limitations, time, safety, morale, and implementation.
 - How will we know when problem solved?
2. Prioritize list.
3. Reach consensus on solution

B. Tools:

- | | |
|------------------------------|--------------------|
| 1. Brainstorming | 4. Flow Charts |
| 2. Nominal Group Technique | 5. Pareto Diagrams |
| 3. Cause and Effect Diagrams | 6. Decision Matrix |

STEP 5. IMPLEMENT THE SOLUTION:

Objective: Convert improvements into a plan which can be implemented and do everything possible to ensure the plan will work well.

A. Tasks:

1. Identify tasks that need to be done.
2. Identify who is to accomplish these tasks.
3. Identify when tasks are to be completed.
4. Document why the tasks are required.
5. Establish tracking system
6. Identify required training
7. Prepare procedures/standard modifications
8. Identify process effectiveness measurement system.
9. Plan for periodic process audits.
10. Coordinate with implementors to obtain their buy-in and ownership.
11. Finalize a clear and concise plan.
12. Conduct management presentation (if required).

B. Tools:

1. Brainstorming
2. Nominal Group Technique
3. A Management Presentation
4. Flow Charts

STEP 6. EVALUATE THE SOLUTION:

Objective: Monitor the process to ensure the implemented improvements are working and periodically re-evaluate the improved process.

Tasks:

- Determine the key points of measurement that will help you keep track of the process.
- Educate the data gatherers to ensure they track the right information and record it accurately.
- Gather and Analyze the Data.
- Check improvement against the original data.

Tools:

- | | |
|------------------------------|--------------------|
| 1. Check Sheets | 4. Histograms |
| 2. Cause and Effect Diagrams | 5. Pareto Diagrams |
| 3. Graphs/Charts | 6. Control Charts |

SUMMARY

TEAM TOOLS AND TECHNIQUES SUMMARY

Now that you've completed the ToolBook and/or training course for Team Tools and Techniques, let's review where we've been.

For the Team Tools:

First, we looked at a tool for "generating ideas." We saw that Brainstorming is a structured approach to thinking which helps a group of people use their collective brainpower to generate new ideas - usually with the goal of solving a problem. We used the example of overcrowding at the base gym and developed many possible solutions to the gym overcrowding problem. Of course, we did not evaluate the ideas generated at this early stage in the problem solving process - we simply tried to get as many ideas as possible.

Second, we looked at tools for "making decisions." First we looked at Nominal Group Technique (NGT). NGT, you will recall, is a tool for narrowing the ideas generated during brainstorming into possible solutions to a problem. We continued the example of the overcrowded base gym and narrowed the ideas generated during brainstorming into possible solutions to fix the overcrowding problem. Then we looked at another tool for "making decisions" - the Decision Matrix. This tool is useful when we must decide on the best option to solve a problem. It is especially helpful when we have institutional "key considerations" to keep in mind as we go about selecting a solution to a problem. We used the example of selecting an office furniture supplier when we had key considerations (Cost, Availability, Quality, Delivery, and Appearance) that impacted our decision.

Third, we looked at tools for "analyzing problems."

- Flowcharts
- Pareto Analysis
- Cause and effect

Finally, we looked at tools for "analyzing data."

- Histogram
- Run Chart
- Control Chart

We then put the tools and techniques together by using the six-step problem solving process and appropriate tool. This six step process is summarized as:

STEP 1. IDENTIFY AND SELECT THE PROBLEM

STEP 2. ANALYZE THE PROBLEM

STEP 3. GENERATE POTENTIAL SOLUTIONS

STEP 4. SELECT AND PLAN THE SOLUTION

STEP 5. IMPLEMENT THE SOLUTION

STEP 6. EVALUATE SOLUTION

section 3: example problems

**** NOTE ****

These are hard copy notes of the scenarios in the
ToolBook for student use.

SECTION 3 EXAMPLE PROBLEMS

Flowchart Scenario:

Your task is to build a macro and micro flow chart depicting the process of suiting up in chemical warfare gear.

Macro Process:

1. Put on pants
2. Put on jacket
3. Put on boots
4. Put on gloves
5. Check the seal after each operation

Micro Process:

1. Get pants
2. Check for rips
3. Put on pants
3. Zip pants
4. Tie leggings
5. Secure velcro
6. Draw cords tight
7. Check seal
8. Go to macro step 2

Pareto Chart Scenario:

Late Takeoff Causes

(last 60 days)

Cause Occurrences

Bad Weather 3

Pilot 1

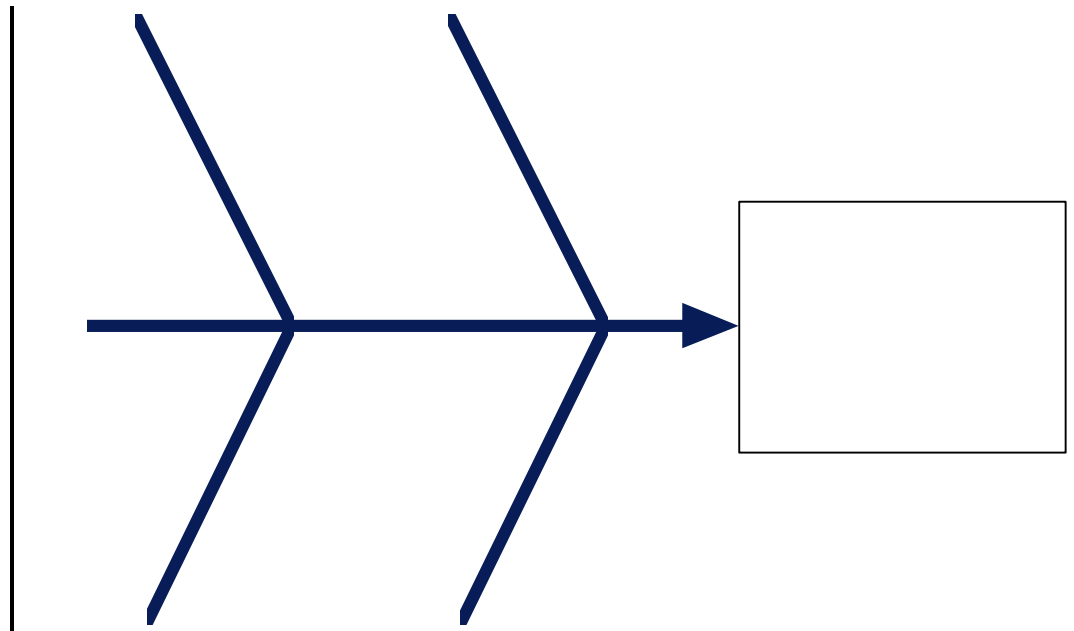
Air Traffic Control 1

Aircraft Servicing 13

Maintenance 7

Cause and Effect Scenario:

After constructing a Pareto Chart on late takeoffs, we discovered that aircraft servicing was the largest contributing factor to our problem. In order to narrow down potential causes, we decide to construct a cause and effect diagram on late takeoffs due to aircraft servicing.



Histogram Scenario:

You have been tasked to analyze travel voucher processing times in order to determine if there is room for improvement. You decide to construct a histogram to determine the frequency distribution of the various times.

4	6	6	8	5	6	7	7	5	7	6	7	3	4	8	6	6
6	5	6	5	7	8	9	6	10	3	4	6	5	6	6	7	8
5	7	6	6	8	5	6	9	5	1	3	7	9	6	5	4	2
6	6	5	7	5	3	5	7	5	2	6	8	6	7	4	6	6
6	8	10	5	4	6	7	6	4	6	5	4	7	9	6	5	4
6	5	2	4	7	3	7	6	6	5	6	6	5	7	4		

section 4: extra problems

**** NOTE ****

**These are extra problems for the student to test their knowledge
and understanding of specific tools and techniques**

SECTION 4. EXTRA PROBLEMS

DECISION MATRIX EXERCISE

SCENARIO: Your team has been tasked to recommend which copier your office should purchase. Funding is tight so you must make a good choice. Here are some key considerations.

COPY MACHINE OPTIONS TABLE

BRAND	\$PER COPY	WxDxH (inches)	PRICE	OPTIONS	RELIABILITY
Canon	\$.03	48x24x36	\$15K	Variable size, 9 copies, 4 shades, collates, 2 sided, 20 originals, copy counter	9
Sharp	\$.02	40x24x36	\$17K	Two sizes of copies, 3 shades, collates, 2 sided, 20 originals, copy counter	9
Ricoh	\$.025	40x24x36	\$14K	Two sizes of copy, 4 shades, 2 sided copies, 10 originals per copy, copy counter, collates	7
Konica	\$.015	54x24x36	\$11K	Two sizes of copies, 2 shades, does not collate, 2 sided copy, 10 originals, copy counter	6
Mita	\$.02	40x24x36	\$16k	Variable size, 8 copies, 4 shades, collates, 2 sided copy, 20 originals, copy counter	8

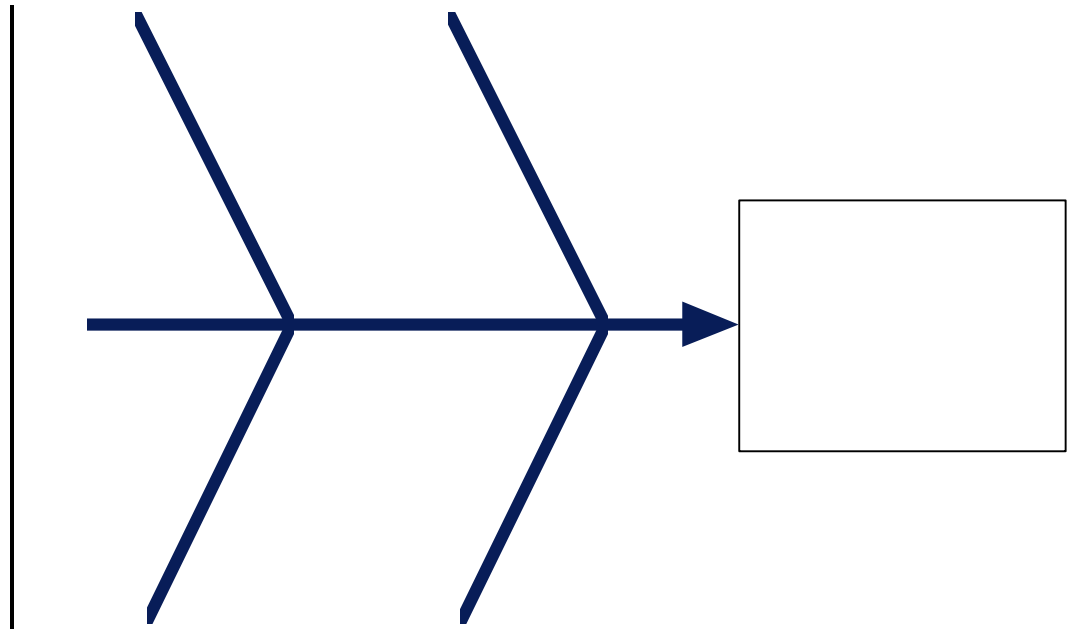
PARETO EXERCISE

SCENARIO: The data below represents the results of a hypothetical study of interruptions to productive work in an office.

TASK: Draw a Pareto chart based on this table:

<u>INTERRUPTIONS</u>	<u>FREQUENCY OF OCCURRENCE</u>	<u>AVG LENGTH OF INTERRUPTIONS (IN MINUTES)</u>	<u>TOTAL TIME INTERRUPTIONS (IN MINUTES)</u>
COMPUTER			
PROBLEMS	7	30	210
TELEPHONE CALLS	70	2	140
WAITING FOR			
APPROVAL	10	10	100
MEETINGS	9	120	1080
WAITING FOR EQUIP	2	30	60
BIRTHDAY PARTIES	1	30	30
INTERVIEWS BY			
SECURITY PERSONNEL	1	30	30

CAUSE AND EFFECT EXERCISE



SCENARIO: Your work area keeps coffee available for its employees. Until recently, its always tasted fine. But for the last two weeks, everyone agrees that its tasted good sometimes and terrible other times. You want to determine what some of the possible causes could be.

TASK: Construct a Cause and Effect Diagram which shows the possible causes of bad tasting coffee

HISTOGRAM EXERCISE

SCENARIO: You are studying the controlled correspondence process in your office. In an attempt to understand why there is overdue correspondence, you track how long it takes for controlled correspondence to go through the process.

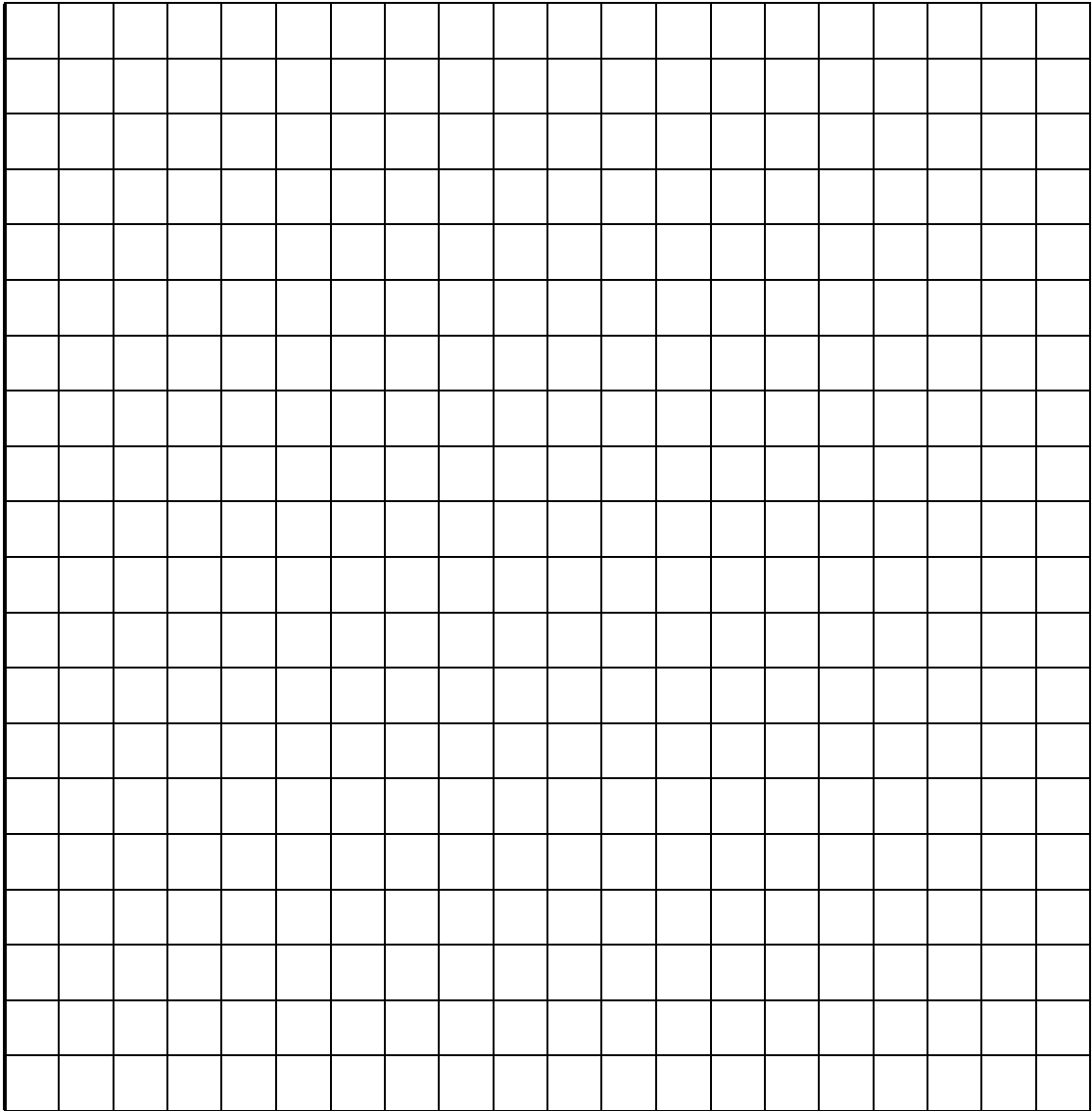
TASK: Construct a histogram which shows variation in the process.

39	60	20	47	51	48	57	78	50	44
79	46	84	21	37	61	7	37	29	63
78	10	28	65	3	55	88	62	56	64
31	71	70	53	99	68	15	22	76	43
50	54	25	38	80	21	54	75	35	74
72	51	0	52	67	53	69	33	45	67
72	55	92	32	48	33	57	51	58	68
32	66	41	66	17	47	23	42	44	91
65	56	19	46	25	58	59	43	52	73
40	82	45	89	49	36	52	98	12	88

RANGE = _____

NUMBER OF MEASUREMENTS	NUMBER OF CLASS INTERVALS
50 - 100	5 - 10
100 - 200	6 - 12
OVER 200	10 - 20

Class Intervals	TALLY	Frequency Observed

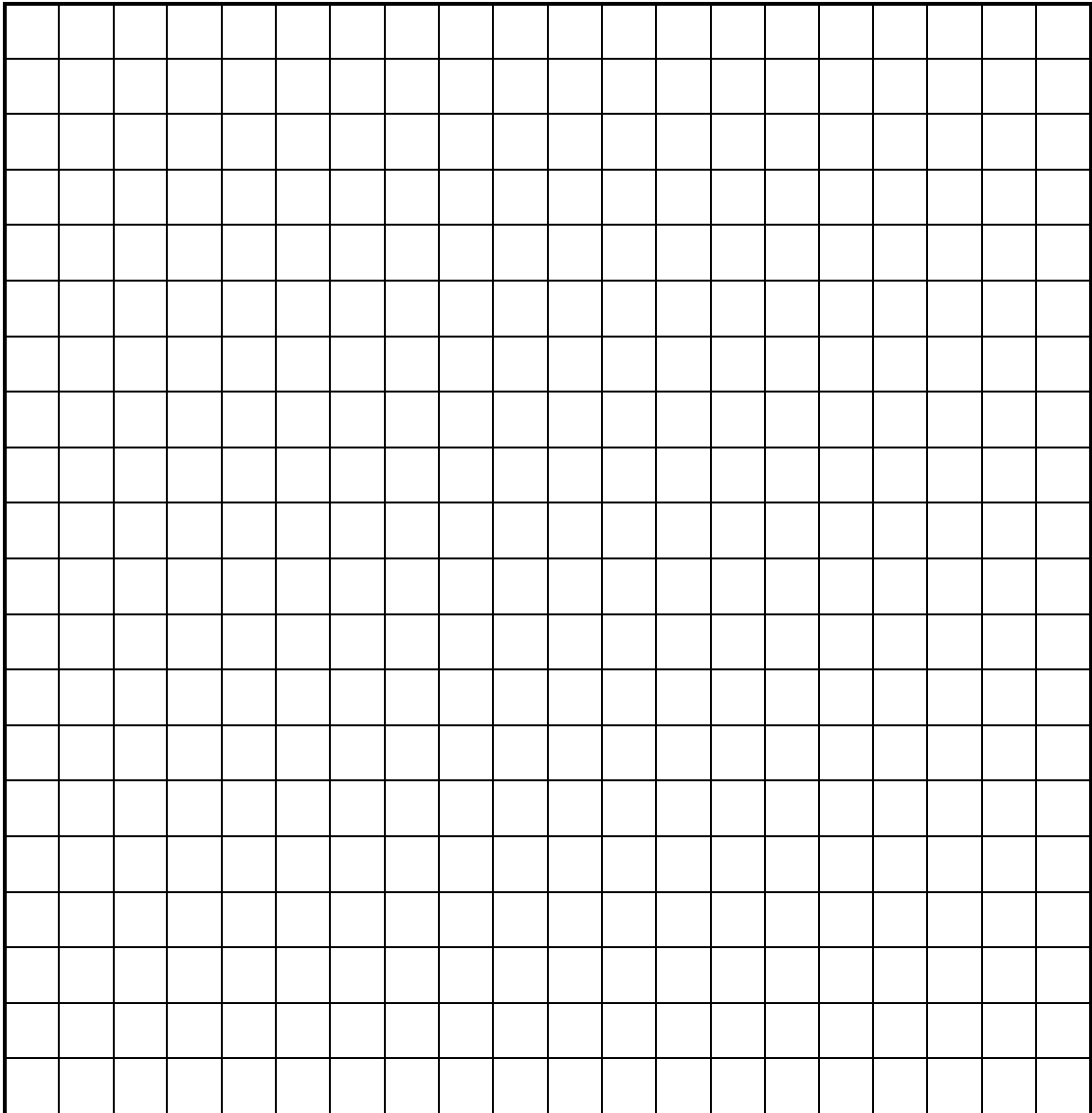


RUN CHART EXERCISE

SCENARIO: You are the manager of a large procurement division. You've just learned about run charts and you have decided to track daily errors made in documentation in your division for a 15 day period. You decide to do this for 3 consecutive 15 day periods.

TASK: Construct the run chart for the first 15 day period using this data:

12, 8, 17, 14, 10, 13, 7, 10, 9, 7, 16, 11, 8, 8, 12



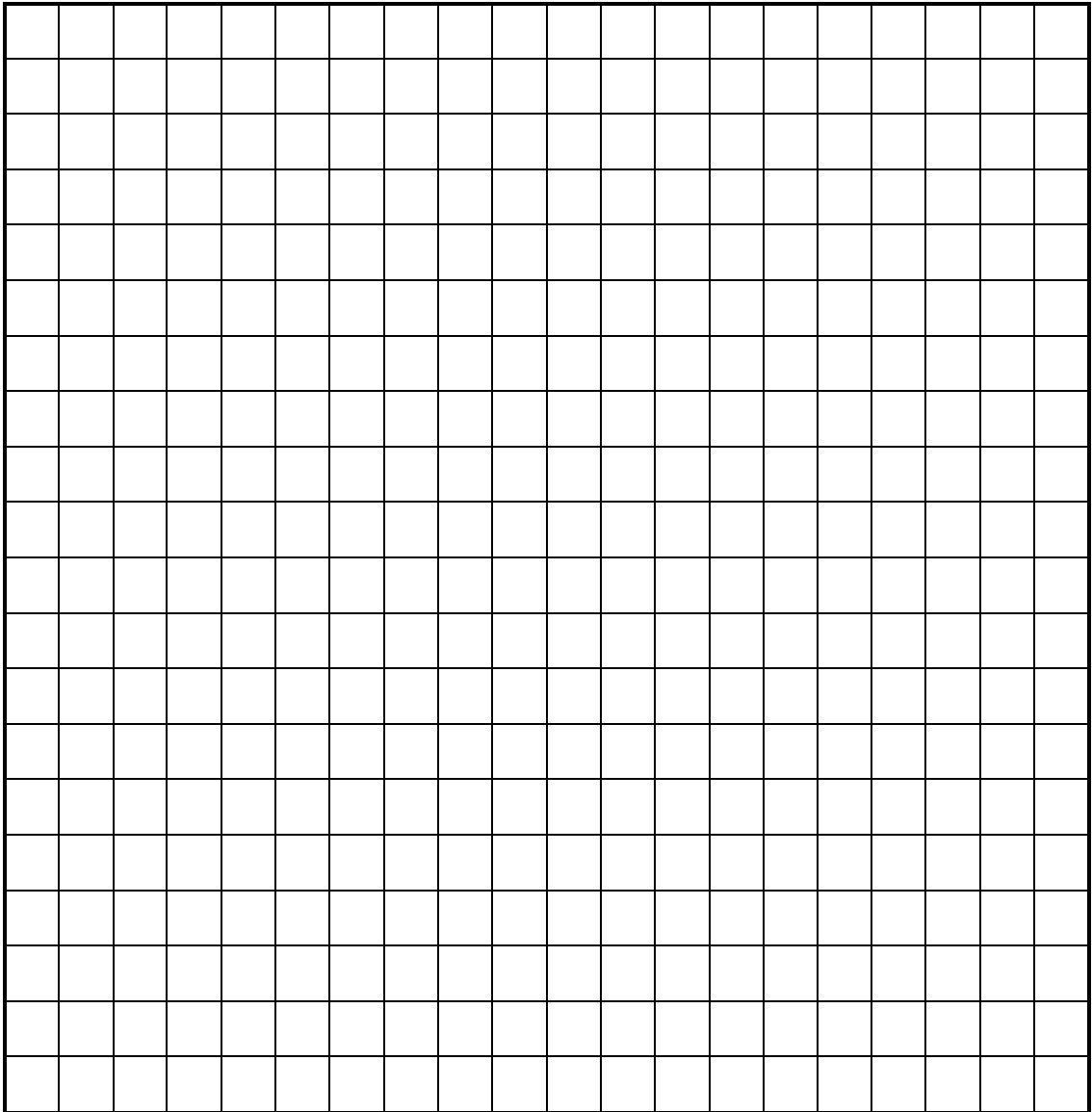
CONTROL CHART EXERCISE

SCENARIO: The base fire department must arrive at the flight line within one (1) minute of an alarm, plus or minus ten (10) seconds. The actual response time was measured five (5) times each work day for four (4) weeks, a total of twenty (20) days.

TASK: Analyze the response process times using an average-range control chart.

Data	TRIAL (in secs)				
<u>WEEKDAY</u>					
1	2	3	4	5	
Week 1					
Monday					
61	61	57	56	60	
Tuesday					
52	62	59	62	67	
Wednesday					
55	56	52	60	59	
Thursday					
59	60	59	49	42	
Friday					
55	67	53	66	60	
Week 2					
Monday					
56	56	61	67	58	
Tuesday					
63	56	60	55	46	
Wednesday					
62	65	63	59	60	
Thursday					
60	59	60	65	65	
Friday					
62	51	62	52	58	

Week 3				
Monday				
62	62	72	63	51
Tuesday				
65	62	59	62	63
Wednesday				
68	64	67	60	59
Thursday				
59	61	58	65	64
Friday				
70	63	68	62	61
Week 4				
Monday				
70	70	50	68	71
Tuesday				
65	70	73	70	69
Wednesday				
64	68	65	72	73
Thursday				
75	72	75	64	69
Friday				
60	68	66	69	72



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BIOGRAPHIES

QUALITY TOOLS (95-079F)

Edward Brown: Major Brown received his commission in the United States Air Force through Officers Training School in 1981. He received his Bachelor in Social Science from Florida State University and his Masters in Human Resources Management from Pepperdine University. His most recent tour was with the 39th Wing, Social Actions Officer, Incirlik Air Force Base, Turkey. He has taught classes in Human Relations, Management, and Quality Awareness and Tools Application. Major Brown is a 1995 graduate of the Air Command and Staff College and is assigned as an ACSC faculty member and Quality Advisor.

Rex Jordan: Major Jordan received his commission in the United States Air Force through Officers Training School in 1980. He earned a Bachelor of Science Degree in Chemistry in 1979 from the University of Alabama and a Master of Science Degree from Embry-Riddle Aeronautical University in 1989. Previous assignments include E-3 AWACS navigator, Tinker AFB, OK., VC-137, Special Missions Navigator, Andrews AFB, MD, and Chief, Presidential Flight Support, HQ USAF, Washington, DC Major Jordan is a 1993 graduate of Air Command and Staff College and is currently an ACSC faculty member.

Michael W. Lamb, Sr.: Project Team Leader. Major Lamb received his commission in the United States Air Force through the Airman Education and Commissioning Program, completing Officer Training School in 1983. He has served as an engineer in key research and development/test and evaluation programs from missiles to flying on B-52 bombers.

He most recent tour was with Twentieth Air Force, serving as the senior engineer and as the first Quality Advisor to the commander and seven missile wings. He was named the top Quality Advisor receiving the 1993 Kaizen Award. He has also received the National Courage Award from President Reagan and the Ten Outstanding Young Americans Award from President Bush. He has numerous publications and a book to his credit. Major Lamb is a 1995 graduate of Air Command and Staff College and is assigned to the Defense Intelligence Agency.

Matthew C. Pincket: Project Advisor. Major Pincket is a career pilot with operational tours in helicopters, airlifters, and trainers. He was commissioned through the Officer Training School in 1979. His assignments include Executive Officer, Indian Springs AFAF, Nevada; Chief of Training, Fort Rucker, Alabama; Airlift Control Element Operations Officer, Charleston AFB, South Carolina; and Assistant Operations Officer, Columbus AFB, Mississippi. Major Pincket is a 1994 graduate of Air Command and Staff College and is currently an ACSC faculty member.

Carl J. Puntureri: Major Puntureri received his commission in the United States Air Force through Officer Training School in April 1980. He earned a Bachelor of Science in biology from Grove City College in 1979 and a Master of Aviation Management from Embry-Riddle Aeronautical University in 1988. Major Puntureri has served six tours in aircraft and munitions maintenance at the squadron, wing, numbered Air Force, and MAJCOM levels. Major Puntureri is a 1995 graduate of Air Command and Staff College and is assigned to HQ EUCOM.

Debra S. Sites: Major Sites received a direct commission in 1982 upon graduating from the University of Florida. After completing her internship she was assigned to the Surgical

Unit at Barksdale AFB Hospital and two years later was assigned to the Intensive Care/Recovery Unit. Major Sites was reassigned to Castle AFB CA in January 1987 as the OIC Medical/Surgical Unit. During this time she completed a dual Masters in Public/Health Administration. Major Sites became the OIC of Emergency Services in February 1990. In July 1991, she was assigned to the 57th Aeromedical Evacuation Squadron at Scott AFB IL during which time she spent one year as the 375th Airlift Wing Executive Officer. Major Sites is a 1995 graduate of Air Command and Staff College and is assigned to 74th Medical Group, Pediatric Unit at Wright-Patterson AFB.